Stochastic Parameters in Lunar Laser Ranging

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Lunar laser ranging data are used to estimate several dozen parameters relating to the Earth, the Moon, and the lunar and planetary ephemerides. Most of these parameters are treated as deterministic and global, where a single value of each parameter is estimated from the entire span of data. However, unpredictable stochastic variations in pole position and UT1, on the time scale of a few days, cause a corresponding stochastic behavior in instantaneous station longitudes and latitudes that must be accommodated in the estimation process.

A separate value of a stochastic parameter is estimated with each data point. To estimate deterministic and stochastic parameters concurrently a Kalman-smoothing technique has been incorporated into the square-root information filter. This paper will summarize the underlying Kalman approach and will highlight the techniques, algorithms, and results of its implementation.

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